Case Report

Cardiovascular monitoring in patients with hypertrophic obstructive cardiomyopathy in a prone position: A report of 2 cases

ABSTRACT

Supine positioning in patients with hypertrophic obstructive cardiomyopathy (HOCM) can affect their preload, afterload, and heart rate, potentially leading to cardiovascular collapse. Here, we report the successful anesthetic management of two patients with HOCM who underwent spinal surgery in a prone position. The approximate values of the systemic vascular resistance index (SVRI) were continuously calculated without measuring the central venous pressure. Intraoperative monitoring of the SVRI estimates may be helpful in patients with HOCM so as to avoid cardiovascular collapse when monitoring with both transesophageal echocardiography and a central venous catheter is clinically inappropriate.

Key words: Cardiovascular collapse; hypertrophic obstructive cardiomyopathy; prone position; systemic vascular resistance index

Introduction

Hypertrophic obstructive cardiomyopathy (HOCM) is characterized by asymmetric hypertrophy of the left ventricle with left ventricular outflow tract obstruction (LVOTO).[1] LVOTO is affected by the preload, afterload, and heart rate (HR).[1] Changing the position of a patient with HOCM can affect these parameters, potentially leading to a cardiovascular collapse.[2] Intraoperative transesophageal echocardiography (TEE) helps patients with HOCM undergoing noncardiac surgery.[1] However, it is sometimes unsuitable, depending on the surgery and the patient's surgical positioning. Herein, we describe the efficacy of the Vigileo/FloTrac™ system (Edwards Lifesciences, Irvine, CA, USA) in the intraoperative management of two patients with HOCM, where monitoring with both TEE and a central venous catheter (CVC) was clinically inappropriate.

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Case Reports

Case 1

A 67-year-old man with a history of hypertension and HOCM was scheduled to undergo posterior spinal fusion for a thoracolumbar spine fracture. He had experienced syncope several times despite being on a daily dose of 5 mg bisoprolol

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fumarate. Preoperative echocardiography detected a moderate LVOTO with a peak pressure gradient of 48 mmHg.

In the operating room, the arterial line was established in his left radial artery before anesthetic induction and was connected to the Vigileo/FloTrac™ system. Considering the risks of arrhythmias induced by CVC insertion and the moderate invasiveness of the surgery, CVC was not used. Accordingly, the approximate values of the systemic vascular resistance index (SVRI) were calculated using the Vigileo/FloTrac system™, assuming that the central venous pressure (CVP) was zero. Therefore, we focused on the trends of the SVRI estimates and the actual values of the stroke volume variation (SVV) and cardiac output (CO) throughout the procedure. After fluid preloading, anesthesia was induced under continuous administration of landiolol at 0.04 mg/kg/min and phenylephrine at 5 mcg/min. The hemodynamic variables calculated with the Vigileo/FloTrac system™ were recorded from the time point immediately after intubation. Following tracheal intubation, the patient was placed in a prone position with continuous monitoring of the hemodynamic variables. His hemodynamics were kept stable intraoperatively by maintaining higher SVRI and lower HR compared to the control (i.e., the data immediately after intubation) under continuous administration of landiolol (0.01–0.1 mg/kg/min) and phenylephrine (5–10 mcg/min). After the patient was placed in a supine position at the end of the surgery, a higher dose of landiolol (more than 0.1 mg/kg/min) was required because of increased HR, over 80 beats/min (bpm). After his hemodynamics were stabilized in a supine position, extubation was carried out uneventfully [Figure 1a].

Case 2

A 55-year-old woman with a history of hypertension who had occasionally experienced chest discomfort was scheduled to undergo lumbar laminectomy for lumbar canal stenosis. Echocardiography was therefore performed before surgery to evaluate her cardiac function. Subsequently, she was diagnosed with HOCM with a moderate LVOTO and a peak pressure gradient of 42 mmHg.

In the operating room, the arterial line was established before anesthetic induction. In this case, the hemodynamic variables were calculated and recorded from the time point immediately before induction. Similar to case 1, the approximate values of the SVRI were calculated without CVC. The pre-anesthetic systolic blood pressure (SBP), HR, and SVV were over 200 mmHg, around 80 bpm, and 4%, respectively. Therefore, during anesthetic induction, the continuous infusion of landiolol at 0.03 mg/kg/min was commenced without fluid preloading and phenylephrine administration. Following tracheal intubation, the patient was placed in a prone position with continuous monitoring of the hemodynamic variables. Subsequently, continuous infusion of phenylephrine at 5 mcg/min was required because of decreased SBP. During surgery, the phenylephrine infusion dose was increased up to 15 mcg/min to maintain higher SVRI and avoid hypotension. HR was kept around 60–70 bpm intraoperatively using landiolol [Figure 1b].

Discussion

Intraoperative cardiovascular collapse is not uncommon in patients with HOCM.[1,2] The anesthetic goal in such patients is to maintain an adequate preload and afterload, reduce left ventricular contractility and HR, and maintain the sinus rhythm.[1] For example, fluid preloading and the use of vasopressors that are devoid of inotropic and chronotropic effects are recommended in treating hypotension.[1] Besides, controlling the HR with beta-blockers to between 60 and 65 bpm is also recommended.[1]

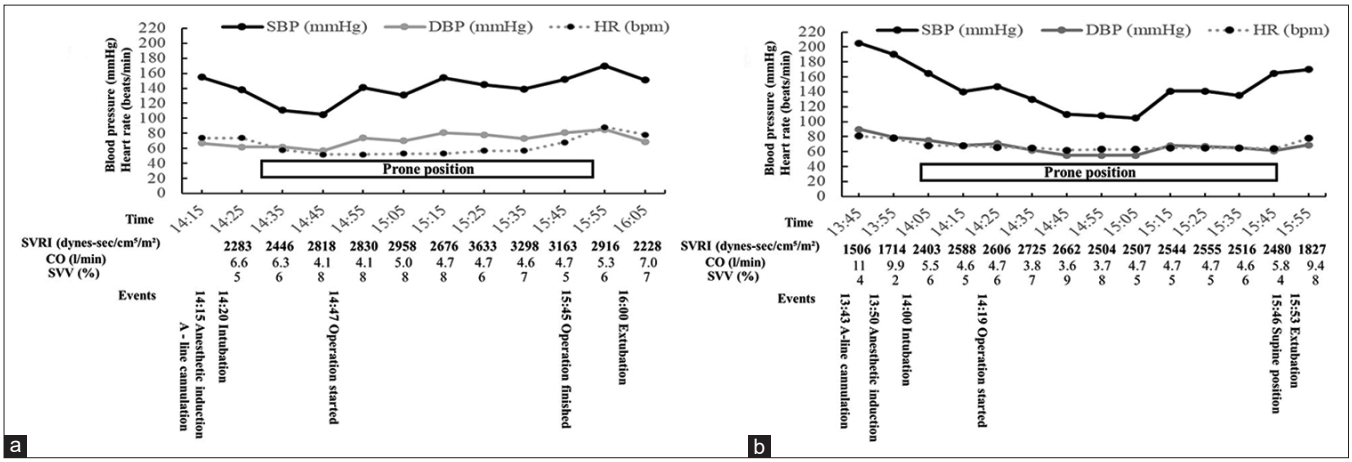

Figure 1: (a and b) represent systolic blood pressure (SBP), diastolic blood pressure (DBP), heart rate (HR), cardiac output (CO), stroke volume variation (SVV), and systemic vascular resistance index (SVRI) estimates along with the intraoperative time course and events in cases 1 and 2, respectively

Following the recommendations regarding the HR control,[1] we maintained the HR at around 60–70 bpm intraoperatively with landiolol in both cases. Furthermore, fluid preloading and the use of a vasopressor were also applied to maintain an adequate preload and afterload. Regarding the afterload, to ensure a safety margin, we set the targeted value of the estimates of SVRI at more than 2400 dynes-s/cm^5/m^2 (normal range of SVRI: 1800–2400 dynes-s/cm^5/m^2) with a continuous infusion of phenylephrine. Mechanical ventilation in a prone position reduces CO due to an increase in intrathoracic pressure and subsequent decrease of the venous return. Considering the etiology of cardiovascular collapse in HOCM patients in a prone position, we prioritized maintaining blood pressure with a higher SVRI and reducing HR over producing sufficient CO intraoperatively in avoiding cardiovascular collapse.

In both cases, CVP was estimated to be less than 10% of the mean arterial blood pressure (MAP). Thus, we considered that the value of CVP was ignorable for the calculation of SVRI. Furthermore, it was reported that the calculation of SVR could be simplified to MAP/CO × 79.92 instead of MAP-CVP/CO × 79.92.[3] Therefore, the calculation of SVRI was simplified to MAP/CI × 79.92 in our cases.

We focused on the trends of SVV (%) throughout the procedure regarding the preload evaluation. SVV (%) was maintained to be less than 10 (%) throughout the procedure in both cases. SVV is a better predictor of preload responsiveness compared to blood pressure and HR. When SVV (%) is more than 12–13 (%), the preload responsiveness is highly predicted.[4] Therefore, we estimated that an adequate preload was maintained in both cases.

In conclusion, continuous intraoperative monitoring of the SVRI estimates calculated without CVP may help in the anesthetic management of patients with HOCM, where monitoring with both TEE and CVC is clinically inappropriate.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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